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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re patent application of: Leif Einar AUNE

For: DISTRIBUTED IP-POOL IN GPRS

CERTIFICATE OF MAILING BY EXPRESS MAIL

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BOX PATENT APPLICATION
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Sir:

PATENT APPLICATION TRANSMITTAL LETTER

Transmitted herewith for filing, please find the following:

1. (XX)   The specification of the above-referenced patent application is
enclosed herewith (_10_ page(s) including claim(s) and Abstract).

2. (XX)   ___1___ sheet(s) of:
___ informal drawing(s) is (are) enclosed herewith.
_X_ formal drawing(s) is (are) enclosed herewith.

3. ( )   This application is a:
___ Continuation
___ Divisional
___ Continuation-In-Part
of prior copending parent application
Serial No. _____ filed on _____, now pending.
Please amend the application to insert the following line in the
beginning of the specification:
--This application is a Continuation of prior
application Serial No. _____ filed on _____, now
pending.--
In the event that a petition to extend time under 37 CFR 1.136 is
necessary in the parent application to maintain copendency for this
application, a petition for an extension of the necessary time to
maintain copendency is hereby requested for the parent application
and the Commissioner is hereby authorized to debt our Account Number
10-0447 for the necessary fees.

4. (XX)   The fees for this application have been calculated and included as shown below (Prior to calculating the fees, please enter any enclosed preliminary amendment.):

	NO. FILED	NO. EXTRA	RATE	FEE
BASIC FEE				**$690**
TOTAL CLAIMS	10-20	0	$18	0
INDEPENDENT CLAIMS	2- 3	0	$78	0
MULTIPLE DEPENDENT CLAIM(S) PRESENTED			$260	
TOTAL FEES:				**$690.00**
Deduct one-half of fee for Small Entity				
TOTAL AMOUNT DUE:				**$690.00**

   X   Checks in the amount of $ 690.00 and $40.00 are enclosed herewith. Please charge any deficiency or credit any overpayment to Deposit Account No. 10-0447 .

____   Please charge my Deposit Account No. _____ in the amount of $_____. Please charge any deficiency or credit any overpayment to Deposit Account No. _____.

5. (XX)   An oath or declaration is enclosed herewith that is:
   X   Unsigned
____   Newly executed per 37 CFR 1.63(a) and (b).
____   A copy of the executed declaration filed in the prior application upon which priority is based, showing the signature or an indication thereon that it was signed; and:
       ____   This application is being filed fewer than all of the inventors named in the prior application and it is requested that the following name or names be deleted from the list of inventors in the prior application for this continuation or divisional application:

             _____

       ____   The prior application was accorded status under 37 CFR § 1.47 and is accompanied by:
           ____   A copy of the decision granting a petition to accord Sec. 1.47 status to the prior application (unless all of the inventors have or legal representatives have filed an oath or declaration to join in the prior application).
           ____   A copy of the subsequently executed oath(s) or declaration(s) filed by the inventor(s) or legal representative(s) that have subsequently joined in the prior application.

6. (XX)   The power of attorney for this application:
          ____   is appointed in the newly executed Oath or Declaration submitted herewith.
          _X_   is appointed by the power of attorney enclosed herewith.
          ____   remains the same as originally in the parent application.
          ____   was changed during the prosecution of the parent application and a copy of the change in the power of attorney is enclosed herewith.

7. (XX)   The correspondence address for this application shall be:
                     Stanley R. Moore, Esq.
                     Jenkens and Gilchrist, P.C.
                     3200 Fountain Place
                     1445 Ross Ave.
                     Dallas, Texas 75202
          _X_   which is a new correspondence address or a change therein.
          ____   which is the same as originally in the parent application.
          ____   which is the change in the correspondence address that was filed during the prosecution of the parent application.

8. (XX)   Priority is hereby claimed under 35 USC 119 and 172 to the following foreign applications:

Country	Serial No.	Date
NORWAY	19994240	Sept. 1, 1999

          and:
          _X_   A certified copy of each application is enclosed herewith.
          ____   A certified copy of each application was filed in prior application Serial No. _____.

9. ( )   A verified statement claiming small entity status under 37 CFR 1.9 and 1.27:
          ____   is enclosed herewith.
          ____   was filed in parent application Serial No. _____, and such status remains unchanged and is requested for this application.

10. ( )   A preliminary amendment is enclosed herewith.

11. (XX) An Information Disclosure Statement with Modified PTO Form 1449 and a copy of the cited references are enclosed herewith.

12. ( )   An Assignment of the invention to _____ with cover sheet and recordation fee is enclosed herewith for recordation by the Assignment Branch.
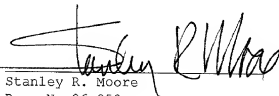
13. (XX) The Commissioner is hereby authorized to charge payment, or to credit any overpayment, of the following fees associated with this filing or during the pendency of this application to Deposit Account No. 10-0447.
          _X_   Any patent application filing fees under 37 CFR 1.16.
          _X_   Any patent application processing fees under 37 CFR 1.17.
          ____   The issue fee under 37 CFR 1.18 at or before mailing of the Notice of Allowance, pursuant to 37 CFR 1.311(b).

14. ( )   Other (specify):_____

    _____

    _____.

15. (XX)   Confirmation Postcard.

                                    Respectfully submitted,

                                    _____
                                    Stanley R. Moore
                                    Reg. No.26,958

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DISTRIBUTED IP-POOL IN GPRS

TECHNICAL FIELD

5   The present invention relates to the filed of mobile data
    communication, and in particular an arrangement for
    distributing IP-addresses in a GPRS network.

TECHNICAL BACKGROUND

    The GPRS (General Packet Radio Service) offers a high-
10 speed, packet-switched, mobile data communication network,
    where the subscribers can connect themselves to an external
    network from a mobile terminal. The subscribers need an IP-
    address to route packets to and from the external network.
    They can specify this address themselves, called static
15 address, or receive an address from the external network or
    the GPRS-system. The last case is then called a dynamic
    address allocation.

    The GPRS system has an internal pool of IP-addresses to be
    used by the subscribers to get a dynamic IP-address. This
20 pool is located on a global processor in the GPRS-system
    and is distributing addresses to all the other processors.
    The global processor will also keep track of which
    addresses are used and which are available for the
    subscribers.

25 THE PROBLEM AREA

    The global processor has to keep track of which addresses
    that are in use, so that it will not give out the same
    address to two subscribers. The operator of the GPRS-system
    will only give in one IP-pool per external network, so the
30 processor have to keep track of the dynamic addresses for
    the whole GPRS-network. This means that it will be
    generated a lot of unwanted traffic towards the global
    processor which holds the IP-pool. Each subscriber,

possibly connected to another processor, have to obtain its address and release it through the global processor.

POSSIBLE SOLUTIONS

One way to solve the problem would have been to configure
5   one IP-pool per processor for each external network. Two arguments show that this is a bad solution. The number of processors in the system should be highly dynamic, and there should be no need for configuration of the processor before start. This means that each processor could not have
10   its own IP-pool. Also, the load could be unevenly distributed among the processors, with the result that one processor has run out of addresses, while the other processors have many unused addresses left. The address-resources would in this case have a low degree of
15   utilisation.

The other way to solve the problem is to allow for all the traffic generated by having only one global address-pool. The advantage with this solution is that all the addresses would be in use before one processor would that report that
20   no addresses were available.

PROBLEMS WITH THESE SOLUTIONS

The above-mentioned solutions will either require a configuration of the processors before start, or result in unwanted traffic towards the global processors in the GPRS-
25   system.

OTHER PRIOR ART

US-patent 5,093,912 describes a method for expanding and contracting a resource pool, mainly with respect to system
30   storage. The patent has no global resource holder to keep track of the overall resource management, but uses an operating system to handle the deletion of a pool of resources. Moreover, the expansion of the pool by acquiring

further resources also involves an external system, such as an operating system.

Allocation of an IP address for an end user in a computer network could not directly be compared to allocation of system storage in a computer. The IP addresses will most likely be kept for several hours, possibly weeks in a GPRS system. Typical memory allocations in a computer system could last for seconds or minutes. The address should also be kept by the subscriber, even though one of the local processors in the GPRS node restarts. This is a very unlikely behaviour of a general computer resource. Thereby, a comparison of an IP-address pool and a typical computer resource pool is not absolutely adequate.

An article from CISCO: New Features in Release 12.1(1)T, http://www.cisco.com...are/ios121/121newft/121t/121t1 /gprs1.htm, Aug 26, 1999, page 14, describes how one can use one DHCP server for all the external networks, instead of letting each external network connected to the GGSN include its own DHCP server. However, no distribution of addresses is done between the different DHCP servers, i.e. the global DHCP server and the local DHCP servers.

THE INVENTION

OBJECTS OF THE INVENTION

It is therefore an object of the present invention to provide an arrangement for providing IP-addresses in a GPRS network which dramatically reduces the traffic towards the global processor that holds the pool of IP-addresses.

Another object is to provide a such arrangement that secures a high and evenly degree of utilisation of the address resources.

BRIEF DESCRIPTION OF THE INVENTION

These objects are achieved in an arrangement for distributing IP-addresses in a GPRS network, which is characterized by the features of the enclosed claim 1.

5   Additional embodiments of the invention appears from the subsequent dependant claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described in detail in reference to the appended drawings, in which:

10   Fig. 1 is a schematical overview of a system for distributing addresses using one global IP-pool (prior art).

Fig. 2 shows the system according to the invention using one local IP-pool per processor for each external network.

15   DETAILED DESCRIPTION

The new solution will still keep one IP-pool per external network for the whole GPRS-system. When a processor receives a request for a dynamic IP-address from a mobile-subscriber, it will signal the global processor that it
20   needs an IP-address. The global processor will now give out a pack of addresses to the requesting processor instead of one address. The processor receiving the addresses will then give one of the addresses to the subscriber and keep the rest of the addresses in an internal storage. When a
25   new subscriber asks for another address the processor now has its own, small IP-pool, from which it can give out an address. After a while, when the processor receives yet another request for an address, and its local IP-pool is empty, it requests the global processor again, and receives
30   another pack of addresses.

Regarding release of the addresses the system works the same way. The remote processor will not release an address

before a whole group of addresses should be released. This
assures that the addresses will be spread out between
processors, which needs them.

The size of the address-blocks are of crucial matter to
make a fine balance between generated traffic to get and
release address-blocks, and to distribute the addresses to
those processors which needs them most. As an example, the
central processor can have 100 addresses available. Of
course, if the processor divides the pool into 50 addresses
in each block, very little traffic will be generated after
two external processes have received a block of addresses,
but then the global pool would be empty, and no other
processes can access any addresses. On the other hand, if
the pool were split in blocks containing only five
addresses, the external processes would have to ask the
global processor about more IP-addresses, or release the
addresses a lot more often. The size of the blocks should
be dynamically adjusted to achieve as little traffic as
possible, without being to liberal with the address
resources.

The system could with advantage comprise an arrangement
which permit the release of addresses that not has been in
use for a long time. E.g. the application processors could
be adapted to report to the global processor with regular
intervals. Should an application processor drop out and not
report, the global processor is allowed to release the
corresponding IP-addresses for other use.

An overview of the messages that may be generated in Figure
1 can be seen in the table below. In the table it is three
processors communicating with the global processor, each
will have two subscribers attached, which needs one address
each. Some of them will release their addresses after a
while. The processors are described as AP's (Application
Processor), and the one owning the IP-pool is defined as
the global processor (AP-global). The last column is

showing the number of messages generated if the new
invention is used.

Table 1: Overview of number of messages

Sender	Message	No of Messages	No of Messages (new variant)
AP1	Get_address	1	1
AP2	Get_address	2	2
AP3	Get_address	3	3
AP1	Get_address	4	3
AP2	Get_address	5	3
AP1	Release_address	6	3
AP3	Get_address	7	3
AP1	Release_address	8	3
AP2	Release_address	9	3

5   Figure 2 shows the new set-up with one internal IP-pool per
     processor. From the table one can clearly see the stop of
     message flow towards the global processor after the local
     processors have received their own, small local IP-pool. No
     messages will be sent as long as the processors do not need
10   more addresses, or have a free, local address-block, which
     can be released.

     The internal storage for each processor's temporary IP-pool
     could be in RAM. It should be aimed at a fast way to access
     the pool, but it should also be kept in mind that the pool
15   must survive a crash of the node. One way to assure this is

to regularly take copies of the local pools and store them persistent, while during traffic the pool is only modified in RAM.

BROADENING

5   This approach reduce intercommunication towards a central resource-handler, and can be used regardless of what kind of resources that should be distributed. As long as the receiving units can store spare resources for future use, and the global resource-pool is large enough to give out

10   excessive resources

CLAIMS

1.   Arrangement for distributing IP-addresses in a GPRS
network, which network comprises a global processor holding
5   a pool of available addresses, and a number of external
networks comprising application processors, which
processors are adapted to supply an address from the global
pool to a user upon request,
each application processor is arranged to hold an internal
10   pool of IP-addresses,
the application processor is adapted to request IP-
addresses from the global processor when said internal pool
is empty or nearly empty,
whereupon the global processor is adapted to respond by
15   transferring a group comprising a number of IP-addresses to
the requesting application processor.

2.   Arrangement according to claim 1,
in which the groups of IP-addresses in said internal pool
20   has a predefined static size.

3.   Arrangement according to claim 2,
in which said processor is adapted to release a group of
addresses and notify the global processor thereof, if the
25   number of addresses in the internal pool of an application
processor exceeds a predefined limit.

4.   Arrangement according to claim 3,
in which said limit is equal to two times the size of the
30   group of IP-addresses last received from the global
processor.

5.   Arrangement according to claim 1,
in which the size of the groups of IP-addresses in said
35   internal pool is dynamically adjusted to achieve as little
traffic as possible, without being too liberal with the
address resources.

6.   Arrangement according to claim 5,
in which said processor is adapted to release a group of
addresses and notify the global processor thereof, if the
number of addresses in the internal pool of an application
5   processor exceeds a predefined limit.

7.   Arrangement according to claim 6,
in which said limit is equal to two times the size of the
group of IP-addresses last received from the global
10   processor.

8. Arrangement according to claim 1,
in which the global processor is arranged to release
addresses that not has been used in a preceding interval of
15   time.

9.   Arrangement according to claim 1,
in which each application processor is arranged to store
said internal pool of IP-addresses in RAM, and make back-up
20   copies of this pool on a persistent storage medium with
regular intervals.

10.   Arrangement for distributing resources in a network,
which network comprises a global processor holding a pool
25   of available resources, and a number of external networks
comprising application processors, which processors are
adapted to supply a resource from the global pool to a user
upon request,
each application processor is arranged to hold an internal
30   pool of resources,
the application processor is adapted to request resources
from the global processor when said internal pool is empty
or nearly empty,
whereupon the global processor is adapted to respond by
35   transferring a group comprising a number of resources to
the requesting application processor.

ABSTRACT

This invention relates to an arrangement to distribute IP-
addresses in a GPRS network. The GPRS system has a pool of
of IP-addresses to be used by subscribers. This pool is
located on a global processor in the GPRS system which is
distributing addresses to all other processors in the
external networks. According to the invention there is
configured one local pool per processor for each external
network. Said local pools is supplied with a pack of
addresses from the global pool. When a local pool is going
empty, the pool is supplied with another pack of addresses
from the global pool. If the local pool exceed a predefined
limit in the number of contained addresses, a pack of
addresses is released. The global pool can then distribute
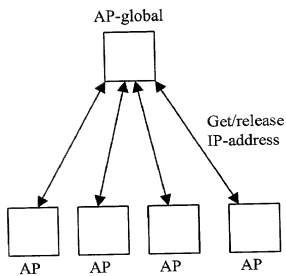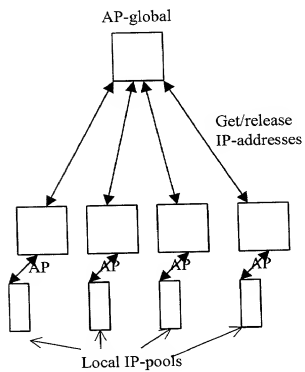these addresses to other local pools.

Figure 1

Figure 2

RULES 63 AND 67 (37 C.F.R. 1.63 and 1.67)
DECLARATION AND POWER OF ATTORNEY

FOR UTILITY/DESIGN/CIP/PCT NATIONAL APPLICATIONS

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name; and

I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: **DISTRIBUTED IP-POOL IN GPRS,** the specification of which: (mark only one)

<u> X </u>   (a)   is attached hereto.

___   (b)   was filed on <u>herewith</u> as Application Serial No. <u> not assigned </u> and was amended on _____ (if applicable)

___   (c)   was filed as PCT International Application No. PCT/_____ on _____ and was amended on _____ (if applicable).

___   (d)   was filed on ___ as Application Serial No. ___ and was issued a Notice of Allowance on ___.

___   (e)   was filed on ___ and bearing attorney docket number ___

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above or as allowed as indicated above.

I acknowledge the duty to disclose all information known to me to be material to the patentability of this application as defined in 37 CFR § 1.56. If this is a continuation-in-part (CIP) application, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose to the Office all information known to me to be material to patentability of the application as defined in 37 CFR § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

I hereby claim foreign priority benefits under 35 U.S.C. § 119/365 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate filed by me or my assignee disclosing the subject matter claimed in this application and having a filing date (1) before that of the application on which my priority is claimed or, (2) if no priority is claimed, before the filing date of this application:

Number	Country	Month/Day/Year Filed	Date first laid-open or Published	Date patented or Granted	Priority Claimed Yes	No
19994240	NORWAY	Sept. 1, 1999			XX	

I hereby claim the benefit under 35 U.S.C. § 120/365 of any United States application(s) listed below and PCT international applications listed above or below:

PRIOR U.S. OR PCT APPLICATIONS

Application No. (series code/serial no.)	Month/Day/Year Filed	Status(pending, abandoned, patented)

NONE

I hereby appoint:

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all of the firm of **JENKENS & GILCHRIST, a Professional Corporation**, 1445 Ross Avenue, Suite 3200, Dallas, Texas 75202-2799, as my attorneys and/or agents, with full power of substitution and revocation, to prosecute this application, provisionals thereof, continuations, continuations-in-part, divisionals, appeals, reissues, substitutions, and extensions thereof and to transact all business in the United States Patent and Trademark Office connected therewith, to appoint any individuals under an associate power of attorney and to file and prosecute any international patent application filed thereon before any international authorities, and I hereby authorize them to act and rely on instructions from and communicate directly with the person/assignee/attorney/firm/organization who/which first sent this case to them and by whom/which I hereby declare that I have consented after full disclosure to be represented unless/until I instruct them in writing to the contrary.

Please address all correspondence and direct all telephone calls to:

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

NAMED INVENTOR(S)

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(FOR ADDITIONAL INVENTORS, check here _ and add additional sheet for inventor information regarding signature, name, date, citizenship, residence and address)